

Polychlorinated dibenzodioxins and dibenzofurans

Polychlorinated dibenzodioxins and dibenzofurans are two groups of chlorinated organic compounds generally referred to as “dioxins”. They are not manufactured intentionally, but are formed as unintended by-products of natural and human-induced combustion of organic materials and in the production of certain chlorinated chemicals and pulp bleaching.

What is the problem?

Dioxins are very persistent in the environment, bioaccumulate in the food chain and are toxic to aquatic organisms, birds and mammals. Waste is considered the dominant source of releases of dioxins to water. Other releases via waste water include industries using chlorine (e.g. pulp and paper, textiles) and chloroorganic industries (e.g. manufacture of vinyl chloride monomer). Emissions to air result from industrial combustion processes (e.g. metal industry, power plants), incineration of wastes and ship engines. Natural events such as forest fires and volcanoes contribute to dioxin releases to air.

What has been done?

OSPAR measures and subsequent EU measures regulate releases of dioxins from the main industrial sources, mainly through the use of best available techniques and emission and discharge limits. EU waste legislation addresses losses of dioxins from wastes. Dioxin releases are regulated worldwide through the UNEP Stockholm POP Convention and the UNECE POP Protocol.

Did it work?

Data on emissions, discharges and losses of dioxins are scarce. Estimates suggest that roughly 20 kg dioxins are still released to the environment each year. One quarter is directly emitted to air, the rest is released via wastes to soil and water. Available data suggest that emissions to air from industrial sources have almost halved in 1998 – 2007. Data on loads of dioxins transported to the sea by rivers and air are not available. Further effort is needed to reduce releases from point sources and diffuse sources, especially wastes, to move towards the cessation target in 2020.

How does this affect the quality status?

Dioxins and dioxin-like congeners (*i.e.* planar PCBs) may induce biological and toxic effects (endocrine disruption, immune system, reproduction). The binding capacity to, and induction potency of, AhR (a protein of the family of cytosolic transcription factors with critical function in organisms) by individual dioxin and furan congeners (as well as PCBs and PAHs) differs considerably. A toxic equivalency factor (TEF) is used to express the induction potency of individual dioxins, PCBs and PAHs relative to 2,3,7,8-tetrachlorodibenzodioxin (TCDD) being the most potent inducer (TEF of 1).

In 2000 – 2006, dioxins have been reported to be found widespread in the OSPAR maritime area. In the Arctic Region, concentrations of dioxins in sediments reach 2.22 ng/kg TEQ at reference and contaminant sites and are considered to be at background concentrations and not of concern. In contrast to the dioxin levels found in herring in the Baltic Sea, fish in the Greater North Sea and the Celtic Seas show contamination levels well below EU dietary limits (up to 0.61 pg/g TEQ at reference sites and 0.87 pg/g TEQ at contaminated sites). Concentrations of dioxins those Regions range in fatty fish between 0.61 pg/g TEQ at reference sites and 0.87 pg/g TEQ at contaminated sites and in shellfish between 0.43 pg/g TEQ at reference sites and 7.95 pg/g TEQ at contaminated sites. Concentrations in northern fulmar eggs range between 3972 and 7793 pg/g l.w. TEQ and exceed several thresholds for biological effects set for different seabird species. Total TEQ levels of dioxins, non-ortho and mono-ortho CBs measured in polar bears are below TEQ thresholds for immune suppression of captive harbour seals. It is unclear whether the comparative TEQ thresholds are

relevant for determining possible serious adverse effects for northern fulmar and polar bears, but the fact that elevated concentrations are found at high trophic levels gives rise to concern. Data is not sufficient to allow indication of trends for the OSPAR maritime area. Without environmental assessment criteria, it is not possible to confirm or exclude that the observed levels have potential for significant adverse effects on marine ecosystems.

Electronic navigator to OSPAR publication sources (publication number):

- Status and trend of marine chemical pollution (395/2009) – Annex 2 for monitoring data
- Background Document for dioxin (308/2007) (as updated)
- Towards the cessation target (354/2008)